DOCUMENT RESUME

ED 057 462 EA 003 853

TITLE The COST-ED Model: A New Economic Tool for the School Administrator.
INSTITUTION Education Turnkey Systems, Inc., Washington, D.C.
PUB DATE [Sep 71]
NOTE 29p.

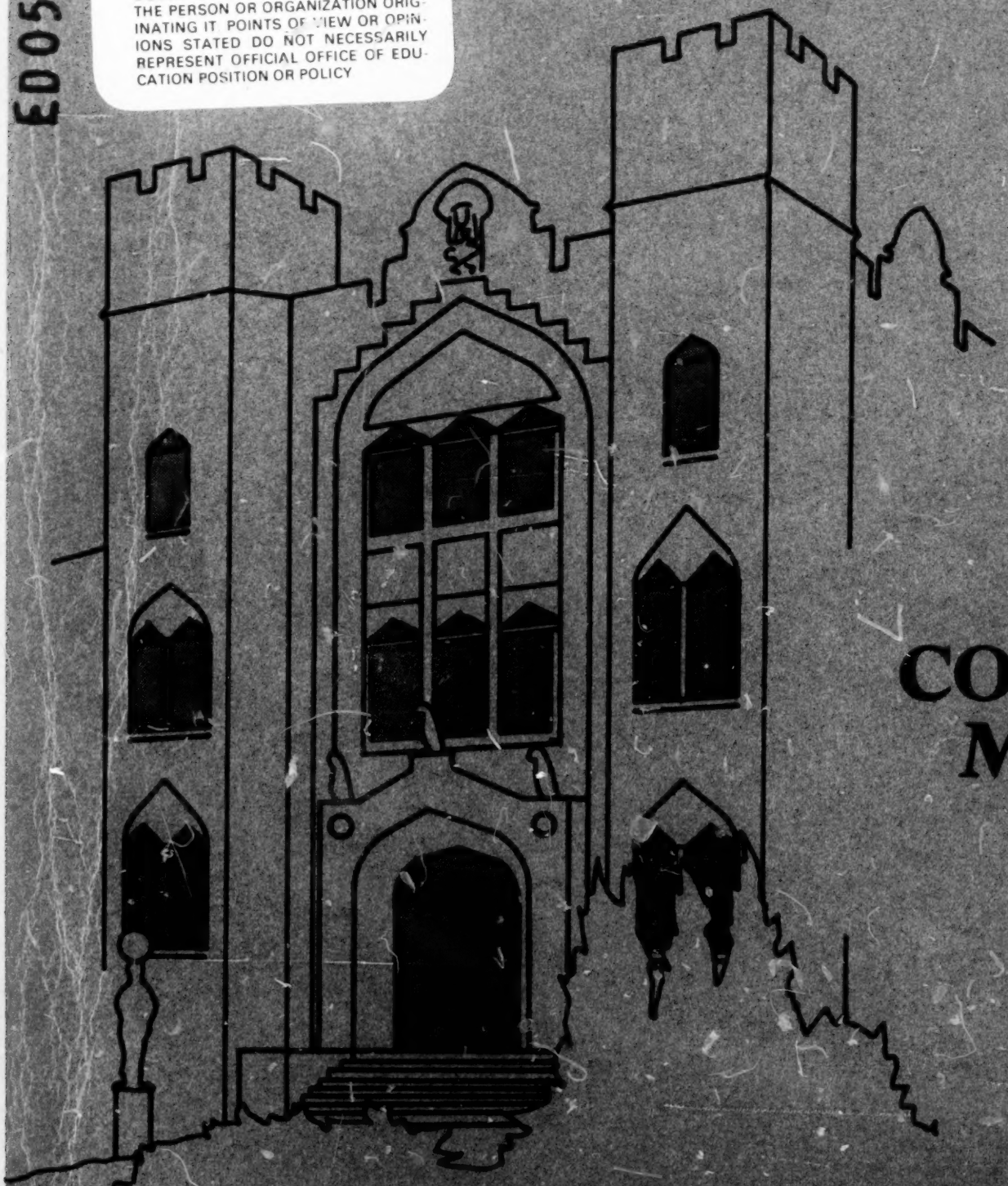
EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS *Computer Oriented Programs; *Cost Effectiveness; Decision Making; *Educational Administration; *Educational Economics; Management; Management Systems; Program Budgeting; Program Evaluation; *Simulation; Systems Analysis

ABSTRACT

This model is a computerized mathematical simulation of the manner in which educational decisions and patterns of school operation affect costs. The design shows how teacher salaries, school building design parameters, and decisions regarding class size and instructional materials expenditures contribute to total school costs. The sophisticated economic analysis provided by the COST-ED model is especially useful in program evaluations, program budgeting, and program simulations. Appendixes present sample computer reports and a glossary of terms. (Author/RA)

ED057462

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY



THE COST-ED Model

A New Economic Tool for the School Administrator

EA 003 853

ETS inc.
EDUCATION TURNKEY SYSTEMS
16[illegible] L St., Washington, D.C. 20036

ED057462

THE COST-ED MODEL:

A New Economic Tool for the School Administrator

Squeezing better educational results from shrinking tax funds demands strong, sound school management.

The school administrator has final responsibility for the effectiveness with which tax dollars for education are spent. This responsibility, however, often exceeds his actual power to control school operations. He must accommodate the pressures of union leaders, educational experts, neighborhood representatives, state legislators, and others in exercising what is left of his discretion on behalf of the children and community-at-large.

Pragmatism demands the recognition that most school decisions are arrived at subjectively through a process of considering a variety of ideas, suggestions, and demands. The overriding of broad, managerial considerations by pressures from the strongest vested interest groups of the moment has played no small part in our schools' current fiscal crises.

The wise administrator strives to keep his prerogatives in line with his responsibilities. He knows he must do this by strengthening and maintaining his store of management information so that the economic impact of all decisions can be considered.

He can do this by controlling the language used in the decision-making process, by full command of all the key facts, and by building good community and governmental relations. Proper use of COST-ED modeling and analysis in proposal definition and evaluation, in provision of a functional and operational accounting for current school operations, and in establishment of "learning per dollar" goals and commitments can help him attain all these sources of strength.

As fiscal pressures lead to tax revolts despite worsening school conditions, it is evident that the power to influence decisions will be increasingly enjoyed by those who offer efficient economic solutions to school problems. If a rash of wanton cost cutting and staff trimming is to be avoided, it is imperative that the currently prevalent system of demands, counter-demands and crisis-precipitating actions give way to constructive, cost-conscious cooperation. Use of COST-ED tools can play a contributory role in helping crystallize this transformation.

TABLE OF CONTENTS

	Page
Introduction	1
Table of Contents	3
The COST-ED Model: General Description	5
COST-ED Computer Reports: Description of Purposes, Formats, and Uses	11
Glossary of Terms: Definitions of Key Terms and Expressions	29

THE COST-ED MODEL

The COST-ED Model is a computerized mathematical simulation of how educational decisions and patterns of school operations affect costs. It traces the contribution to total school costs of decisions on class size and instructional materials expenditures, of teachers' salaries, and of school building design parameters. In all, over 1800 distinct cost-influencing factors may be considered in a COST-ED model.

A model may be designed to represent a complete district's costs, or just those of an individual school. A COST-ED model may be used to allocate costs to individual programs of instruction within a school, or even to distinct elements of the instructional process within a course. The level of detail at which it may be used is flexible, depending upon the analytical objectives selected.

Once built, a COST-ED model may be run on a computer to determine the "what if" cost impact of changes in any of hundreds of cost-influencing factors. Computer reports are prepared showing a ranking of all manageable factors according to their relative power in affecting total costs. Other computerized analyses provide answers to such questions as: How much will a change here affect a cost subtotal there? or, How much of a change here is equivalent to (or needed to offset exactly) a change there?

Considerations of educational effectiveness may be brought into COST-ED analyses through use of historical measurements or informed judgments of the results expected from new programs. A reading-level gain, for instance, may be related in COST-ED analysis to the total costs of the reading program; the result is an accountable measure of the cost per unit of achievement. COST-ED analyses can establish the learning gain benchmark which must be met by a cost-influencing innovation before it is justified on a results-per-

dollar basis.

COST-ED for Program Evaluation

Through the application of the model, the education planner who is experimenting with various instructional programs has a tool to analyze the economics of each pilot program in terms of its cost and the achievement resulting from that program. He can then determine how the pattern of cost incurrence differs from program to program. For example, an administrator may be considering mathematics and reading programs which include the following design features: a ratio of professional teachers to students of 1 to 600, 32 paraprofessionals relying heavily on the use of audio-visual and other automated capital-intensive means of instruction. This program will be characterized by relatively high cost increases in certain areas (e.g., audio-visual equipment) and drastic reductions in others (e.g., annual pay of teachers) compared with other less radical programs such as the current school district program. Using available data on the economics and effectiveness of various instructional programs, the administrator can project the economic cost as well as possible benefits to be achieved if other schools were to adopt and implement specific programs. In this sense, the administrator can use the model for budgetary planning as well as for program planning and evaluation.

COST-ED for Program Simulation

In other instances where the administrator cannot afford to conduct an expensive pilot or demonstration program to determine the cost effectiveness of an instructional program, he might want to use the COST-ED Model as a simulation device to project the nature of the economics and total cost of the proposed program using data gathered elsewhere on effectiveness. In simulating the proposed program, he could relax certain existing constraints within the

school system to determine what he would be saving if he did not have to abide by these constraints which may unduly increase cost without increasing effectiveness. For example, if an instructional program demonstrated and tested elsewhere indicates that through the use of paraprofessionals and automated means of instruction operating twelve hours a day, certain results are achieved but existing school regulations or traditions preclude the hiring of paraprofessionals or the operation of school facilities for twelve hours a day, then he will have a factual basis for determining the cost of not using the most efficient configuration of the learning system.

Using a COST-ED Model of the ongoing instructional program as a basis, the administrator could simulate the effects of many recent education proposals (e.g., team teaching, differentiated staffing, learning centers, twelve month school year) on his own cost structure.

COST-ED and the Program Budget

Like the accounts of a well-designed Planning-Programming-Budgeting System, COST-ED analyses are management-oriented, not auditor-oriented. In fact, COST-ED analysis is a simple, but sophisticated form of the "Planning-Programming" use associated with the type of cost information gathered in a PPBS accounting structure.

COST-ED reports group expenditures by function or purpose of expenditure before splitting them into categories of staff or facilities. In this critical feature they differ markedly from a school budget, which fails to show how much money is used to support reading instruction, or that is spent on teachers doing non-teaching work. At the same time, COST-ED analyses show the surreptitious impact on funds allocations among educational purposes that arise from salary or price changes in various cost categories.

Because of this difference, COST-ED dollar figures may be used in answering questions and supporting judgments that would otherwise require an unaffordable effort with standard budgets. The questions they answer and judgments they inform are those that are oriented toward program evaluation and planning for change.

Is the school properly balancing its expenditures for mathematics with its costs for optional subjects, or would a minor reallocation appear justified? Is there any change in methods of instruction or staff assignments that would reduce non-productive salary costs? Only when these questions are raised on top of well-supported cost figures can the truly central issues of school improvement be addressed. Only when such issues are given proper prominence will they begin to receive the well-deserved attention they have often lost to more parochial distractions.

The COST-ED Model offers a unique facility for expressing the key relationships among budgets, facilities plans, schedules, staff assignments and educational results. It is not a passive language of categories, conceptual structures, or accounts. It is, with its computerized analyses, an active language expressing the dynamics of school operations and projecting the economic effects of changes in them.

Properly used, COST-ED models and analyses can provide much of the framework for coordinated problem-solving among school specialties. By forcing at least some elements of problem definition into a unified language, parochial viewpoints are placed into broader perspective and narrow solutions to problems are discouraged.

Summary

The COST-ED Model is a tool which allows an administrator to conduct

sophisticated economic analyses of his instructional programs, without the exorbitant costs of a PPBE System. It provides him with a mechanism for presenting rational arguments about program design modification and improvement.

COST-ED

Computer Reports

General

From data used in the COST-ED Model of an instructional program, several quantitative reports are prepared. Each is designed for a specific role in economic analysis work.

Six of the reports are designed to verify data and describe the economic characteristics of an entire instructional program. These reports form the basis for investigation of the economics of an existing or planned program of instruction. These six reports are the Cost Analysis Summary, the Client Data Listing, the Program Cost Analysis, the Sensitivity Analysis, the Economic Factor Ranking, and the Program Comparison Summaries.

Two additional reports are prepared only as requested by the analyst or planner. They are designed to offer special assistance in identifying and evaluating alternatives for program improvement. These reports are the Custom Sensitivity Analysis and the Custom Trade-Off Analysis. The two special reports are meant to be repeated as different alternatives for resource allocation are identified, reviewed, and refined. They may be used to highlight specific alternatives of special administrative interest or to develop by heuristic methods a completely redesigned instructional program that is judged to represent a more effective allocation of available funds than the original.

Each of the eight reports is fully described below:

LEVEL: ELEMENTARY
PROGRAM: ACADEMIC

NATIONAL AVERAGE
COST-ED COST ANALYSIS SUMMARY
EDUCATION TURNKEY SYSTEMS

DATE: 09/13/71
PAGE: 1

COST PER STUDENT-YEAR:	$ 783.85
TOTAL COST PER PROGRAM CYCLE:	$ 63613.80
STUDENT OPPORTUNITY COST PER PROGRAM CYCLE:	$ 203884.31
ANNUAL FACILITY OPPORTUNITY COST:	$ 12773.15
VALUE OF ANNUAL STAFF FREE EFFORT:	$ 8319.21

COST ANALYSIS SUMMARY

Purpose: To provide a one-page digest of the key results characterizing an instructional program.

Format: The illustration on page 12 shows a COST ANALYSIS SUMMARY for the typical elementary school in the United States. This summary indicates that the annual cost of elementary education is $783.85 per student and that the total cost for an entire grade level in the typical American elementary school is $63,613.80. The final three statistics are factors which do not directly affect the total costs, but might have a bearing on decision making. Precise definitions of these statistics may be found in the "COST-ED Glossary of Terms."

Use: This report serves as a summary of the detailed Program Cost Analysis report.

COST FACTOR	REFER.	VALUE/UNIT	DATA QUALITY
STUDENT FLOW			
DAYS / WEEK		5.0000 DAYS	SUBSTANTIATED BY SOURCE
CYCLES / YEAR		1.0000 CYCL	SUBSTANTIATED BY SOURCE
DROPOUT RATE		1.0300 %	SUBSTANTIATED BY ETS
PRORATION FACTOR		100.0000 %	SUBSTANTIATED BY ETS
ENROLLMENT			
PRGRM ENROLLMENT		82.0000 STU	SUBSTANTIATED BY ETS
INSTRUCTION			
[illegible] / DAY		4.6010 HRS	SUBSTANTIATED BY ETS
STAFF RATIO	TEACHR	27.3000 #1	SUBSTANTIATED BY SOURCE
IMMED USE COST	CLSRM	0.0085 $	SUBSTANTIATED BY ETS
IMMED USE COST	CLS-FR	0.0 $	SUBSTANTIATED BY ETS
IMMED USE COST	I-EQPT	0.0 $	SUBSTANTIATED BY ETS
BK-AV HOUR COST		0.0118 $	SUBSTANTIATED BY ETS
OTHER HOUR COST		0.0199 $	SUBSTANTIATED BY ETS
PRORATION FACTOR		100.0000 %	SUBSTANTIATED BY ETS
PHYSICAL EDUCATN			
HOURS / DAY		0.3080 HRS	SUBSTANTIATED BY ETS
BK-AV HOUR COST		0.0 $	SUBSTANTIATED BY ETS
OTHER HOUR COST		0.0 $	SUBSTANTIATED BY ETS
RECESS			
HOURS / DAY		0.3610 HRS	SUBSTANTIATED BY ETS
FACIL HOUR COST		0.0 $	SUBSTANTIATED BY ETS
BK-AV HOUR COST		0.0 $	SUBSTANTIATED BY ETS
OTHER HOUR COST		0.0 $	SUBSTANTIATED BY ETS

CLIENT DATA LISTING

Purpose: To identify for review and validation all raw data used in constructing a COST-ED Model.

Format: A sample page from a CLIENT DATA LISTING on page 14 shows an input listing of program factors. Along with each factor is the value of that factor and a Data Quality, giving the degree to which and by whom the value has been verified. For example, the shaded area of the sample CLIENT DATA LISTING indicates that:

-- the typical student spends about 4.6 hours per day in academic instruction and this value was determined by Education Turnkey Systems' observation or computation.

-- the average student:teacher staff ratio in instruction is 27.3:1 and this value was determined by a document or a signed statement from the client.

Use: This report presents to the client for his review a complete listing of the factors and values which were used to construct the client's COST-ED Model.

COST FACTOR	REFER.	VALUE/UNIT	DATA QUALITY	
INSTRUCTION				
HOURS / DAY		4.6010 HRS	SUBSTANTIATED BY ETS	I
DAYS / WEEK		5.0000 DAYS	SUBSTANTIATED BY SOURCE	L
HOURS/ SCHOOL-YR		826.9392 HRS	SUBSTANTIATED BY CALCULATION	C
STAFF RATIO	TEACHR	27.3000 :1	SUBSTANTIATED BY SOURCE	I
AVAIL USE CHARGE	CLSRM	0.1184 $	SUBSTANTIATED BY CALCULATION	L
IMMED USE COST	CLSRM	0.0085 $	SUBSTANTIATED BY ETS	I
TOTAL USE COST	CLSRM	0.1269 $	SUBSTANTIATED BY CALCULATION	C
AVAIL USE CHARGE	CLS-FR	0.0147 $	SUBSTANTIATED BY CALCULATION	L
IMMED USE COST	CLS-FR	0.0 $	SUBSTANTIATED BY ETS	I
TOTAL USE COST	CLS-FR	0.0147 $	SUBSTANTIATED BY CALCULATION	C
AVAIL USE CHARGE	I-EQPT	0.0110 $	SUBSTANTIATED BY CALCULATION	L
IMMED USE COST	I-EQPT	0.0 $	SUBSTANTIATED BY ETS	I
TOTAL USE COST	I-EQPT	0.0110 $	SUBSTANTIATED BY CALCULATION	C
STUDENT-HR COST	TEACHR	0.3597 $	SUBSTANTIATED BY CALCULATION	L
STUDENT-HR COST	CLSRM	0.1269 $	SUBSTANTIATED BY CALCULATION	L
STUDENT-HR COST	CLS-FR	0.0147 $	SUBSTANTIATED BY CALCULATION	L
STUDENT-HR COST	I-EQPT	0.0110 $	SUBSTANTIATED BY CALCULATION	L
FACIL HOUR COST		0.1526 $	SUBSTANTIATED BY CALCULATION	C
STAFF HOUR COST		0.3597 $	SUBSTANTIATED BY CALCULATION	L
FACIL HOUR COST		0.1526 $	SUBSTANTIATED BY CALCULATION	L
BK-AV HOUR COST		0.0118 $	SUBSTANTIATED BY ETS	I
OTHER HOUR COST		0.0199 $	SUBSTANTIATED BY ETS	I
TOTAL HOUR COST		0.5440 $	SUBSTANTIATED BY CALCULATION	C
NET TIME COST		449.8276 $	SUBSTANTIATED BY CALCULATION	C
NET UNIT COST		0.0 $	SUBSTANTIATED BY CALCULATION	C
NET FULL COST		449.8276 $	SUBSTANTIATED BY CALCULATION	C
PRORATION FACTOR		100.0000 %	SUBSTANTIATED BY ETS	I
NET COST/STU-YR		449.8276 $	SUBSTANTIATED BY CALCULATION	C

PROGRAM COST ANALYSIS

Purpose: To show in detail the manner and amount by which each economic factor contributes to total costs, and to show the breakdown of total costs first by function, then by resource type (staff or facility), and then by particular characteristics of each resource.

Format: A sample page from a PROGRAM COST ANALYSIS is shown on page 16 and indicates a portion of the detailed computations necessary to obtain the cost for academic instruction alone. The shaded area of the report indicates costs for academic instruction broken down by type of resource, showing staff, facilities, books/audiovisuals, and other costs contributing about 36¢, 15¢, 1¢, and 2¢ respectively to the total hourly cost per pupil for academic instruction. The calculations for these subtotals are contained in other pages of the PROGRAM COST ANALYSIS.

Since all economic factors for each data group are shown together, this report provides a full economic description of each instructional function or resource used. For each function, it shows the basis of requirements for each staff type used, the usage generated for each facility, and the cost contributions of each staff or facility to total functional costs. For each staff or facility resource, it shows both requirements drawn from the functions modeled to reflect student schedules and the bases for calculating resource charges to each function.

Use: This report is meant to be used in three fashions: as an informative tool, as a basis for program improvement, and as an expression of a complete resource allocation strategy.

As an informative tool, the PROGRAM COST ANALYSIS may be used to show any member of the educational staff how his decisions or actions affect total costs of instruction.

As a basis for program improvement, the PROGRAM COST ANALYSIS is best used in the fashion of a road map. In tracing backwards from cost totals to costs by function, then by resource type, and so on, judgments may be made at each step as to the quality of the balance among each set of subtotals. From these judgments directions may be found for economic program improvement worthy of further analysis.

As an expression of resource allocation strategy, the PROGRAM COST ANALYSIS complements and adds detail to a verbal description of an instructional program. It may be used with a verbal description in comparing program proposals and planning new methods of instruction, contributing the dimension of economics to the many other considerations involved.

LEVEL: ELEMENTARY
PROGRAM: READING

COST-ED SENSITIVITY ANALYSIS
EDUCATION TURNKEY SYSTEMS

DATE: 09/20/71
PAGE: 1

COST FACTOR	REFER.	INITIAL VALUE	COST FACTOR CHANGE YIELDING 1% SAVINGS	1% ADDL COST	COST IMPACT RELATION	RANK OF 155	PERCENTAGE IMPACT ON COST PER STUDENT YEAR: COST FACTOR CHANGE -25%	-10%	-5%	+5%	+10%	+25%
STUDENT FLOW												
SCHOOL YEAR DAYS		180.0000 DAYS	-1.00%	1.00%	POS LIN		-25.0%	-10.0%	-5.0%	5.0%	10.0%	25.0%
READING INSTRUCT												
HOURS / DAY		0.8330 HRS	-2.52%	2.52%	POS LIN	1	-9.9%	-4.0%	-2.0%	2.0%	4.0%	9.9%
STAFF RATIO	TEACHR	28.5000 :1	2.91%	-2.75%	NEG ACC	2	11.8%	3.9%	1.9%	-1.7%	-3.2%	-7.1%
COMP FACTOR 1	TEACHR	0.0313	8.40%	-8.40%	NEG LIN	9	3.0%	1.2%	0.6%	-0.6%	-1.2%	-3.0%
IMMED USE COST	CLSRM	0.0171 $	-64.43%	64.43%	POS LIN	47	-0.4%	-0.2%	-0.1%	0.1%	0.2%	0.4%
TOTAL USE COST	CLSRM	0.1437 $	-10.28%	10.28%	POS LIN		-2.4%	-1.0%	-0.5%	0.5%	1.0%	2.4%
BASIS OF USE	CLSRM	57.0000	11.30%	-9.22%	NEG ACC	10	3.3%	1.1%	0.5%	-0.5%	-0.9%	-2.0%
USE FACTOR 1	CLSRM	180.0000	11.30%	-9.22%	NEG ACC	10	3.3%	1.1%	0.5%	-0.5%	-0.9%	-2.0%
USE FACTOR 2	CLSRM	3.2350	11.30%	-9.22%	NEG ACC	10	3.3%	1.1%	0.5%	-0.5%	-0.9%	-2.0%
TOTAL USE COST	CL-FRN	0.0177 $	-83.33%	83.33%	POS LIN		-0.3%	-0.1%	-0.1%	0.1%	0.1%	0.3%
BASIS OF USE	CL-FRN	57.0000	263.43%	-42.02%	NEG ACC	48	0.5%	0.2%	0.1%	-0.1%	-0.1%	-0.3%
USE FACTOR 1	CL-FRN	180.0000	263.43%	-42.02%	NEG ACC	48	0.5%	0.2%	0.1%	-0.1%	-0.1%	-0.3%
USE FACTOR 2	CL-FRN	3.2350	263.43%	-42.02%	NEG ACC	48	0.5%	0.2%	0.1%	-0.1%	-0.1%	-0.3%
TOTAL USE COST	I-EQPT	0.0162 $	-91.02%	91.02%	POS LIN		-0.3%	-0.1%	-0.1%	0.1%	0.1%	0.3%
BASIS OF USE	I-EQPT	57.0000	468.53%	-45.18%	NEG ACC	57	0.4%	0.1%	0.1%	-0.1%	-0.1%	-0.2%
USE FACTOR 1	I-EQPT	180.0000	468.53%	-45.18%	NEG ACC	57	0.4%	0.1%	0.1%	-0.1%	-0.1%	-0.2%
USE FACTOR 2	I-EQPT	3.2350	468.53%	-45.18%	NEG ACC	57	0.4%	0.1%	0.1%	-0.1%	-0.1%	-0.2%
STAFF HOUR COST	TOTALS	0.4302 $	-3.44%	3.44%	POS LIN		-7.3%	-2.9%	-1.5%	1.5%	2.9%	7.3%
FACIL HOUR COST	TOTALS	0.1777 $	-8.32%	8.32%	POS LIN		-3.0%	-1.2%	-0.6%	0.6%	1.2%	3.0%
BK-AV HOUR COST	TOTALS	0.0088 $	LOW	146.30%	POS LIN	88	-0.2%	-0.1%	-0.0%	0.0%	0.1%	0.2%
OTHER HOUR COST	TOTALS	0.0081 $	LOW	174.82%	POS LIN	91	-0.1%	-0.1%	-0.0%	0.0%	0.1%	0.1%
TOTAL HOUR COST	TOTALS	0.6249 $	-2.37%	2.37%	POS LIN		-10.6%	-4.2%	-2.1%	2.1%	4.2%	10.6%
NET COST/STU-YR	TOTALS	93.6922 $	-2.37%	2.37%	POS LIN		-10.6%	-4.2%	-2.1%	2.1%	4.2%	10.6%
REMEDIAL READING												
HOURS / DAY		0.0868 HRS	-4.13%	4.13%	POS LIN	4	-6.1%	-2.4%	-1.2%	1.2%	2.4%	6.1%
STAFF RATIO	RR-TCH	6.0607 :1	5.50%	-4.96%	NEG ACC	5	6.4%	2.1%	1.0%	-0.9%	-1.7%	-3.8%
COMP FACTOR 1	RR-TCH	0.6593	-13.13%	13.13%	POS LIN	20	-1.9%	-0.8%	-0.4%	0.4%	0.8%	1.9%
TOTAL USE COST	I-EQPT	0.0162 $	LOW	874.94%	POS LIN		-0.0%	-0.0%	-0.0%	0.0%	0.0%	0.0%
IMMED USE COST	RRCLSR	0.0171 $	LOW	830.70%	POS LIN	128	-0.0%	-0.0%	-0.0%	0.0%	0.0%	0.0%
TOTAL USE COST	RRCLSR	0.7497 $	-18.92%	18.92%	POS LIN		-1.3%	-0.5%	-0.3%	0.3%	0.5%	1.3%
BASIS OF USE	RRCLSR	206.0000	24.01%	-16.22%	NEG ACC	27	1.7%	0.6%	0.3%	-0.2%	-0.5%	-1.0%
USE FACTOR 1	RRCLSR	180.0000	24.01%	-16.22%	NEG ACC	27	1.7%	0.6%	0.3%	-0.2%	-0.5%	-1.0%
USE FACTOR 2	RRCLSR	0.0868	20.46%	-14.52%	NEG ACC	23	2.0%	0.7%	0.3%	-0.3%	-0.5%	-1.2%
TOTAL USE COST	RRCLFR	0.1026 $	LOW	138.26%	POS LIN		-0.2%	-0.1%	-0.0%	0.0%	0.1%	0.2%
BASIS OF USE	RRCLFR	206.0000	HIGH	-58.02%	NEG ACC	77	0.2%	0.1%	0.0%	-0.0%	-0.1%	-0.1%
USE FACTOR 1	RRCLFR	180.0000	HIGH	-58.02%	NEG ACC	77	0.2%	0.1%	0.0%	-0.0%	-0.1%	-0.1%

SENSITIVITY ANALYSIS

Purpose: To show how "sensitive" the total cost value is to changes in each economic factor or program design feature.

Format: As shown in the illustration of a SENSITIVITY ANALYSIS on page 18, selected economic factors are listed along with their original values from the Program Cost Analysis. The next two columns give the percentage changes (from its "Initial Value") that each factor would have to undergo, before it would affect total costs by 1%, with other factors remaining unchanged. The first of these columns, "Cost Factor Change Yielding 1% Savings", indicates the percentage change in the value of the factor that would result in a 1% reduction (saving) in total costs. Similarly, the second column, "Cost Factor Change Yielding 1% Additional Cost", indicates the percentage change in the value of the factor that would result in a 1% increase (additional cost) in total costs. The shaded area shows that, for example, the average student: teacher staff ratio in academic instruction must be increased by 2.91% to yield a 1% saving in total cost, or it must be decreased by 2.75% to yield a 1% higher total cost.

The "Cost Impact Relation", the next column to the right, characterizes the relationship between changes in each economic factor and increases in total cost. These relations are either positive or negative and either linear, accelerating, or diminishing.

The "Rank" column indicates the relative importance of each selected economic factor which was included in the Client Data Listing. The factor ranked "1" has a greater impact on total costs than any of the other factors.

The next series of columns, "Percentage Impact on Cost per Student Year", details the basis for the ranking. For various changes in the economic factors, the percentage effect on total cost is given. The shaded area indicates that, for example, a 25% decrease (-25%) in average student:teacher staff ratio in academic instruction would result in a 11.8% increase in total costs.

Use: This SENSITIVITY ANALYSIS is meant to be used in conjunction with the Program Cost Analysis as a basis for program improvement. By highlighting the economic impact of changes in cost factors, this report provides cost data to complement judgments as to the educational effectiveness of changes in the resources involved.

LEVEL: ELEMENTARY
PROGRAM: ACADEMIC

. NATIONAL AVERAGE
COST-ED ECONOMIC FACTOR RANKING
EDUCATION TURNKEY SYSTEMS

DATE: 09/20/71

PAGE: 1

RANK OF 25	DATA GROUP	COST FACTOR	REFER.	COST FACTOR VALUE FOR CHANGE IN COST PER STUDENT YEAR: 1% SAVINGS	INITIAL VALUE	1% ADDL COST	COST IMPACT RELATION	RELATIVE POWER
1	INSTRUCTION	STAFF RATIO	TEACHR	27.9358 :1	27.3000 :1	26.6925 :1	NEG ACC	100
2	CLASSROOM TEACHR	ANNUAL SALARY		8830.1758 $	9025.0000 $	9219.8203 $	POS LIN	95
3	CLASSROOM	PEAK USE %		93.1856 %	100.0000 %	106.8144 %	POS LIN	30
4	CLASSROOM	RAW UNIT RQMTS		30.4779 UNIT	33.0070 UNIT	35.5361 UNIT	POS LIN	27
5	CLASSROOM	UNIT ACQ COST		18.9630 $	20.6100 $	22.2570 $	POS LIN	26
6	STUDENT FLOW	DROPOUT RATE		0.0631 %	1.0300 %	1.9799 %	POS ACC	22
7	PRINCIPAL&STAFF	ANNUAL SALARY		28700.0000 $	31673.6992 $	34647.3945 $	POS LIN	22
8	CLASSROOM	USEFUL LIFE		56.0187 YRS	50.0000 YRS	45.1495 YRS	NEG ACC	21
9	CLASSROOM	OVERHEAD %		54.6237 %	62.5450 %	70.4662 %	POS LIN	16
10	CLASSROOM	BOND MATURITY		17.1317 YRS	20.0000 YRS	22.8683 YRS	POS LIN	14
10	CLASSROOM	INTEREST RATE		5.4307 %	6.3400 %	7.2492 %	POS LIN	14
12	INSTRUCTION	COMP FACTOR 1	TEACHR	0.1703	0.2005	0.2307	POS LIN	14
13	CLASSROOM	OP COST/UNIT-DAY		0.0027 $	0.0033 $	0.0039 $	POS LIN	12
14	CLASSROOM TEACHR	FRINGE RATE		6.3534 %	8.7000 %	11.0466 %	POS LIN	8
15	CLASSROOM	MAINT COST/$-YR		0.0122 $	0.0171 $	0.0220 $	POS LIN	7
16	DIST.ADMIN.STAFF	ANNUAL SALARY		42930.1797 $	61884.8398 $	80839.5000 $	POS LIN	7
17	MULTIPURPOSE RM.	RAW UNIT RQMTS		3.3389 UNIT	5.8680 UNIT	8.3971 UNIT	POS LIN	5
18	INSTRUCTION	OTHER HOUR COST	TOTALS	0.0104 $	0.0199 $	0.0294 $	POS LIN	4
19	PRINCIPAL'S AREA	RAW UNIT RQMTS		2.4830 UNIT	5.0120 UNIT	7.5410 UNIT	POS LIN	4
20	CLASSROOM FURN.	RAW UNIT RQMTS		22.6972 UNIT	59.0800 UNIT	95.4628 UNIT	POS LIN	3
21	INSTRUCTION	BK-AV HOUR COST	TOTALS	0.0023 $	0.0118 $	0.0213 $	POS LIN	3
22	INSTRUCTNL.EQPT.	RAW UNIT RQMTS		2.5948 UNIT	18.9900 UNIT	35.3851 UNIT	POS LIN	2
23	KITCHEN	RAW UNIT RQMTS		LOW	2.2670 UNIT	4.7960 UNIT	POS LIN	2
24	KITCHEN	USEFUL LIFE		HIGH	50.0000 YRS	15.4312 YRS	NEG ACC	1
25	DIST.ADMIN. AREA	RAW UNIT RQMTS		LOW	2.1500 UNIT	6.7519 UNIT	POS LIN	1

Note: This is an abbreviated Economic Factor Ranking, for display purposes. Rankings for most instructional programs contain between 100 and 300 key cost factors.

ECONOMIC FACTOR RANKING

Purpose: To focus attention on those economic factors which have the greatest impact on total cost per student-year or per unit of achievement and to show the relative economic importance of individually managed program design features.

Format: A sample ECONOMIC FACTOR RANKING is shown on page 20. This report ranks, in order of its influence on total cost, each input cost factor listed on the Sensitivity Analysis report. The first column gives the rank of the factor, the second column gives the Data Group with which the factor is associated, and the third column gives the name of the factor.

The three columns in the middle of the page show the "Cost Factor Value for Change in Cost per Student Year." To either side of each factor's "Initial Value", are values for the factor that would cause a "1% Savings" in total cost or a "1% Addl Cost"(additional cost).

The "Cost Impact Relation" for each cost factor is repeated from the Sensitivity Analysis report.

The "Relative Power" column measures the relative economic importance of each program design feature (cost factor). The impact on total costs of a change in the first-ranked factor is arbitrarily given the relative power rating of 100. The impact of a corresponding change in each subsequent factor is then calculated as a percentage of the impact of this first-ranked factor. An economic factor with a relative power of 5, for instance, will cause only 5% as much change in total cost as the first-ranked factor, when both are changed by corresponding amounts.

One of the shaded portions of page 20 shows that the most important determinant of total cost is the average student:teacher staff ratio in instruction, and that an increase in this class size parameter from its initial value of 27.3 students to about 27.9 students would result in a 1% saving in total cost. Similarly, instructional equipment dollar investment per student (raw unit requirements) is ranked 22nd and has a relative power to effect total costs of 2. This investment in audio-visual hardware could be increased from its initial value of $18.99 per student to $35.39 per student before total costs go up by 1%. It can be seen that if class size were increased to 27.9 students (1% savings) and equipment investment increased to $35.39 per student (1% additional cost), the total cost would be the same as for the initial configuration. This "different" program (larger classes, more equipment) represents an equal-cost alternative to the initial program design.

Use: The Economic Factor Ranking clarifies the relative economic importance of each basic design feature of an instructional program. It is designed to focus attention on the critical economic factors, to provide a basis for efforts toward program improvement, and to indicate the importance of possible data estimation errors.

COST-ED PROGRAM COMPARISON SUMMARIES
EDUCATION TURNKEY SYSTEMS

COST FACTOR	REFER.	UNIT OF MEASURE	STDELE	MUSCRE	MUSCMS	INKCRE	INKCMS	STDSEC
STUDENT FLOW								
DAYS / CYCLE NOM		DAYS	178.8000	184.0000	184.0000	180.0000	180.0000	178.8000
ENROLLMENT								
PRGRM ENROLLMENT		STU	82.0000	72.0000	285.0000	57.0000	269.0000	250.0000
INSTRUCTION								
HOURS / DAY		HRS	4.6010	1.0830	0.9170	0.3330	0.8000	4.4770
STAFF RATIO	TEACHR	:1	[illegible]	26.5000	25.9100	28.5000 *	33.6250	28.3000
BK-AV HOUR COST	TOTALS	$	0.0118	0.0093	0.0096	0.0088	0.0193	0.0121
OTHER HOUR COST	TOTALS	$	0.0199	0.0186	0.0192	0.0081	0.0083	0.0206
CLASSROOM TEACHR								
FRINGE RATE		%	8.7000	2.3400	2.3400	8.0620	7.6840	8.4000
ANNUAL SALARY		$	9025.0000	8696.8086	9328.7383	11171.7383	10347.2188	9540.0000
CLASSROOM								
RAW UNIT RQMTS		UNIT	33.0070	30.0330	31.6940	26.3640	44.0460	39.7470
OVERHEAD %		%	62.5450	95.7780	32.0929	91.1059	60.2869	34.6199
UNIT ACQ COST		$	20.6100	22.3770	30.2410	29.5000	29.5000	23.8480
INTEREST RATE		%	6.3400	6.2500	6.2500	6.0000	6.0000	6.3400
OP COST/UNIT-DAY		$	0.0033	0.0036	0.0036	0.0037	0.0024	0.0033
MAINT COST/$-YR		$	0.0171	0.0160	0.0160	0.0045	0.0045	0.0171
INSTRUCTNL.EQPT.								
RAW UNIT RQMTS		UNIT	18.9900	6.4290	11.2270	21.1875	9.6789	21.4500
TOTALS								
COST / STU-YEAR		$	783.8518	168.2014	178.0302	221.0182	166.4935	912.5938

PROGRAM COMPARISON SUMMARIES

Purpose: To display summary descriptions of various COST-ED models for use in comparison of program characteristics with those of the basic model.

Format: The sample report, illustrated on page 22, displays selected cost factors for a number of different instructional programs. The illustration shows key factors for six different (coded) instructional programs. The bottom line under each program shows the total cost of each program. The shaded area on the sample report shows the comparison of the average student: teacher staff ratio in instruction for six programs, ranging from 25.91 students to 33.625 students.

Use: This report could be used to allow alternate systems of instruction to be compared readily with the basic model under consideration. This comparison would allow the planner, at a glance, to consider further possibilities for detailed analysis substituting one of the alternative instructional programs directly into the planner's current overall structure.

Specifically, this list could help an education planner visualize the important economic factors involved in turnkeying any experimental program into his system. The user can specify which factors in each of the programs under consideration are to be listed. The Program Cost Analysis reports for each of the programs can be used as a basis for identifying those economic factors which are most amenable to change as opposed to those which would be difficult, in a political sense, to affect.

The planner would then have a Program Comparison Summaries report run for those factors which would be difficult to change, and probably another report run for those factors more amenable to change. The two reports would greatly assist him in any turnkey decision-making; if a seemingly attractive pilot program relied heavily on politically cast-in-stone factors, this program would be a less likely candidate for turnkey than another program which involved more manageable factors.

The report could be viewed as a turnkey shopping list showing, at the same time, all the important factors involved in a number of alternative programs as well as the requirement each of these programs has for each of the factors.

LEVEL: ELEMENTARY
PROGRAM: READING

COST-ED CUSTOM SENSITIVITY ANALYSIS
EDUCATION TURNKEY SYSTEMS

DATE: 09/14/71
PAGE: 1

S E N S I T I V I T Y O F

****
TOTALS NET COST/STU-YR READNG
****

T O C H A N G E S I N

****
CLASSROOM TEACHR STAFF RATIO READNG
****

	CLASSROOM TEACHR STAFF RATIO READNG		TOTALS NET COST/STU-YR READNG	CORRESPONDING PERCENTAGES OF CHANGE FROM INITIAL VALUES
INITIAL VALUES:	28.5000 :1	AND	93.6922 $	
ALTERNATIVE 1:	14.2500 :1	YIELDS	151.8781 $	-50.0% AND 62.1%
ALTERNATIVE 2:	21.3750 :1	YIELDS	119.4105 $	-25.0% AND 27.4%
ALTERNATIVE 3:	25.6500 :1	YIELDS	102.2649 $	-10.0% AND 9.1%
ALTERNATIVE 4:	27.0750 :1	YIELDS	97.4571 $	-5.0% AND 4.0%
ALTERNATIVE 5:	27.9300 :1	YIELDS	95.2124 $	-2.0% AND 1.6%
ALTERNATIVE 6:	29.0700 :1	YIELDS	92.6803 $	2.0% AND -1.1%
ALTERNATIVE 7:	29.9250 :1	YIELDS	90.7974 $	5.0% AND -3.1%
ALTERNATIVE 8:	31.3500 :1	YIELDS	88.1014 $	10.0% AND -6.0%
ALTERNATIVE 9:	35.6250 :1	YIELDS	81.4801 $	25.0% AND -13.0%
ALTERNATIVE 10:	42.7500 :1	YIELDS	73.0321 $	50.0% AND -22.1%

CUSTOM SENSITIVITY ANALYSIS

Purpose: To show how changes in any one economic factor affect requirements for any other economic factor or cost subtotal.

Format: The sample CUSTOM SENSITIVITY ANALYSIS, illustrated on page 24, shows the impact of changes in the student:teacher staff ratio in a reading program on the net cost per student-year of that reading program. The values of the factor to be varied are given in the left-most of the two center columns and the effects of these variations on the other factor are given in the next column. These values are translated into percentages in the two right-hand columns of the page. The shaded portion of page 24 shows that a 25% reduction in the average student:teacher staff ratio in reading (from 28.5 to 21.375) will cause the total cost of the reading portion of the overall program to increase by 27.4% (from $93.69 to $119.41).

Use: This report is meant to be used in much the same fashion as the regular Sensitivity Analysis, but to allow the analyst to select factors other than the total cost per student-year as the factor whose sensitivity to changes in other economic factors is under inspection.

LEVEL: ELEMENTARY
PROGRAM: ACADEMIC

NATIONAL AVERAGE
COST-ED CUSTOM TRADE-OFF ANALYSIS
EDUCATION TURNKEY SYSTEMS

DATE: 09/13/71
PAGE: 1

T R A D E - O F F O F

****
CLASSROOM TEACHR ANNUAL SALARY
****

A G A I N S T

****
TOTALS BK-AV HOUR COST INSTRC
****

S U B J E C T T O

****
TOTALS TOT COST/STU-YR = 783.8518 $
****

R E M A I N I N G U N C H A N G E D

	CLASSROOM TEACHR ANNUAL SALARY		TOTALS BK-AV HOUR COST INSTRC	CORRESPONDING PERCENTAGES OF CHANGE FROM INITIAL VALUES
INITIAL VALUES:	9025.0000 $	AND	0.0118 $	
EQUAL COST ALTERNATIVE 1:	4512.5000 $	AND	0.2314 $	-50.0% AND 1860.6%
EQUAL COST ALTERNATIVE 2:	6768.7500 $	AND	0.1216 $	-25.0% AND 930.3%
EQUAL COST ALTERNATIVE 3:	8122.5000 $	AND	0.0557 $	-10.0% AND 372.1%
EQUAL COST ALTERNATIVE 4:	8573.7500 $	AND	0.0338 $	-5.0% AND 186.1%
EQUAL COST ALTERNATIVE 5:	8844.5000 $	AND	0.0206 $	-2.0% AND 74.4%
EQUAL COST ALTERNATIVE 6:	9205.4961 $	AND	0.0030 $	2.0% AND -74.4%
EQUAL COST ALTERNATIVE 7:	9476.2461 $	AND	NEGATIVE $	5.0% AND LOW%
EQUAL COST ALTERNATIVE 8:	9927.4961 $	AND	NEGATIVE $	10.0% AND LOW%
EQUAL COST ALTERNATIVE 9:	11281.2500 $	AND	NEGATIVE $	25.0% AND LOW%
EQUAL COST ALTERNATIVE 10:	13537.5000 $	AND	NEGATIVE $	50.0% AND LOW%

CUSTOM TRADE-OFF ANALYSIS

Purpose: To show equal-cost alternatives for funds allocations between two economic factors, to show how one economic factor or corresponding program design feature must be changed to absorb the cost differences related to a change in another, and to show how changes in total funds available may be split among changes in two economic factors or corresponding program design features.

Format: A sample CUSTON TRADE-OFF ANALYSIS is shown on page 26. This report depicts a series of equal-cost alternatives to the original instructional program subject to an economic constraint (generally total costs are constrained to remain unchanged). Each of the equal-cost alternatives are listed, with the two columns in the center of the report giving pairs of values for each factor which will leave the constraint unchanged. The shaded portion of the CUSTOM TRADE-OFF ANALYSIS illustration on page 26 indicates, for example, that, if total cost per student-year were to remain unchanged, a reduction in teachers' average salaries of 5% (from $9,025 to $8,573.75) would allow expenditures for books and audiovisual software (BK-AV HOUR COST) to go up by 186.1% (from 1.18¢ per student-hour to 3.38¢ per student-hour).

Use: This CUSTOM TRADE-OFF ANALYSIS report offers the educational manager alternative ways of allocating his funds so as to maintain a fixed cost total. In reviewing possibilities for program improvement, a judgment as to the associated educational effectiveness of each "Equal-Cost Alternative" may be made, and the one with highest expected effectiveness chosen for further study.

This report may also be used to dramatize the impact that changes in any one economic factor or program design feature have on limiting affordable values for any other. A one-student change in the classroom student-staff ratio, for instance, may be related quantitatively in Custom Trade-Off Analyses to the changes needed (to maintain total program costs fixed) in teaching materials budgets, investments in plant and equipment, or the like.

Alternatives for splitting changes in total program costs among economic factors or corresponding program design features may also be shown in a Custom Trade-Off Analysis. By subjecting the equal-cost alternatives to a constant value of the limiting factor set above or below its initial value, the report will show how the additional funds, or cutbacks, may be split between the factors traded-off against each other.

GLOSSARY OF TERMS

Academic Instruction - that portion of the student's schedule which is devoted to academic subjects (e.g., reading, mathematics, music, science, social studies), excluding such activities as physical education, recess, lunch, etc.

Achievement - any measure of student improvement, given in units such as grade level increases or raw score improvements.

ANNUAL FACILITY OPPORTUNITY COST - the cost (of a facility) which is incurred while the facility is idle.

BK-AV HOUR COST - the expenditures per student-hour for books and audiovisual software.

Client Data Listing - the COST-ED Computer Report which presents the data used to construct each COST-ED Model.

Constraint - in the Custom Trade-Off Analysis report, the value which must remain unchanged while the equal-cost alternatives are being computed.

Cost Analysis Summary - the COST-ED Computer Report which gives a short overview of each COST-ED Model's key characteristics.

Cost Factor - see Economic Factor.

Cost Impact Relation - a description of the relationship between each economic factor and total cost.

Cost per Student-Year - see TOTAL COST PER STUDENT YEAR.

Cost per Unit of Achievement - the cost required to raise a student's achievement from one level to the next higher level.

COST-ED Model - a detailed description of the incurrance of costs in an instructional program.

Custom Sensitivity Analysis - the COST-ED Computer Report which shows how changes in an economic factor affect requirements for another economic factor or cost subtotal.

Custom Trade-Off Analysis - the COST-ED Computer Report which presents equal-cost alternatives for funds allocations between two economic factors.

Data Group - a collection of information within a COST-ED Model which describes either a Function, a Staff, or a Facility, and which contains all the associated economic factors.

Data Quality - a notation in the COST-ED Computer Reports which indicates the degree to which each data item has been substantiated.

Economic (Cost) Factor - any variable in a COST-ED Model.

Economic Factor Ranking - the COST-ED Computer Report which presents key economic factors in order of their influence on total costs.

Equal-Cost Alternatives - combinations of economic factors that will cause total cost to be the same.

FACIL HOUR COST - the cost per student-hour of building and equipment facilities.

Facility - a resource such as equipment or a portion of a building which is consumed over time.

Function - an activity in which a student takes part during his school day or which exists so that the student may take part in other functions.

Initial Value - the value of an economic factor (as shown in the Program Cost Analysis), before it is subjected to sensitivity or trade-off analysis.

Instructional Program - any organized instruction which is conducted in a similar manner for all students enrolled.

NET COST/STU-YR - the cost of only one function of an instructional program.

OTHER HOUR COST - the expenditures per student-hour for materials (other than books and audiovisual software) and miscellaneous supplies.

Program Comparison Summaries - the COST-ED Computer Report which displays summary descriptions of various COST-ED Models.

Program Cost Analysis - the COST-ED Computer Report which shows the detailed breakdown of total costs.

Program Design Feature - any economic factor which describes an instructional program.

Raw Unit Requirements - the basic per-pupil requirement for a facility, generally square feet for building facilities and dollars for equipment facilities.

Relative Power - a measure of the impact an economic factor has on total costs, relative to other economic factors.

Resource - any physical object whose use incurs cost (e.g., staff, facility, books, supplies).

Sensitivity Analysis - the COST-ED Computer Report which shows the impact on total cost of changes in economic factors.

Simulation - the use of the COST-ED Model to describe a hypothetical instructional program.

Staff - a human resource such as a teacher, paraprofessional, principal's staff, etc.

STAFF HOUR COST - cost per student-hour for staff resources.

Staff Ratio - the economic factor which describes the ratio of students to staff types.

STUDENT OPPORTUNITY COST PER PROGRAM CYCLE - the forgone value of the time a student spends in an instructional program.

TOTAL COST PER PROGRAM CYCLE - the total cost for all students in an instructional program.

TOTAL COST PER STUDENT-YEAR - the total annual cost for one student in an instructional program.

TOTAL HOUR COST - the total cost per student-hour for all resources consumed.

Trade-Off - the values of two economic factors which are subject to a constraint, usually that total cost remains unchanged.

Turnkey - the process of adopting for inclusion in the curriculum of a school district an instructional program used by a performance contractor, or demonstrated in some other experimental program.

VALUE OF ANNUAL STAFF FREE EFFORT - the total value of uncompensated staff time, work done beyond normal school hours.